First observations of sprites using the Israeli Infrasound Network

Intended for the Lightning Effects on the Middle and Upper Atmosphere (including TLEs) session

David Applbaum, Colin Price (Department of Geophysical, Atmospheric, and Planetary Sciences, Tel Aviv University, Ramat Aviv 69978 Israel, cprice@flash.tau.ac.il), and Yochai Ben Horin

Infrasound waves are pressure waves that propagate at frequencies of between 0.01 and 20 Hz, below the range of frequencies audible to the human ear. They are generated by disturbances to large volumes of air, and can travel great distances across the globe using waveguides created by the changing properties of the different layers of the atmosphere. Natural sources of infrasound include ocean swells, volcanoes, earthquakes, and bolide impacts.

While infrasound monitoring is not a new concept, it has experienced a renaissance in recent years owing to its ability to detect man-made disturbances such as nuclear weapons tests. As such, a vast worldwide infrasound network was built by the Comprehensive Nuclear Test Ban Treaty Organization (CTBTO), and though the network's primary objective is to detect man-made explosions, the relative infrequency of these explosions leaves it open to scientific uses most of the time. Two detector arrays were recently built in Israel and constitute the Israeli Infrasound Network (IIN). The IIN arrays are separated by several hundred kilometers, such that incoming signals may be triangulated and their approximate origins known.

A recent such use of the CTBTO infrasound network has been the monitoring of thunderstorms. The infrasound group at the French Atomic Energy Commission (CEA) was able to track the paths of thunderstorms using infrasound as well as identify a specific signal that sprites leave in the infrasound.

In order to further this work, we have been using as ground truth events optical observations of TLEs by the Imaging of Lightning and Nocturnal flashes (ILAN) science team at Tel Aviv University. Because the exact natures and approximate locations of these events are known, and because these TLEs occur quite close to the detectors, we are able to search for them in the local Israeli Infrasound Network (IIN) with a relatively high degree of precision. We have recently identified what we believe to be the first sprites observed in infrasound in Israel. They present themselves as a unique "inverted chirp" in the infrasound signal, whereby the higher frequencies arrive at the detector array just before the lower frequencies. The length of the signals received is on the order of one minute per sprite. Both this signal format and signal length are in agreement with the work published previously by the CEA. Lastly, the observed locations of the sprites are in agreement with the calculated origins of the infrasound waves.